

THE MINERALS INDUSTRY OF ZAMBIA

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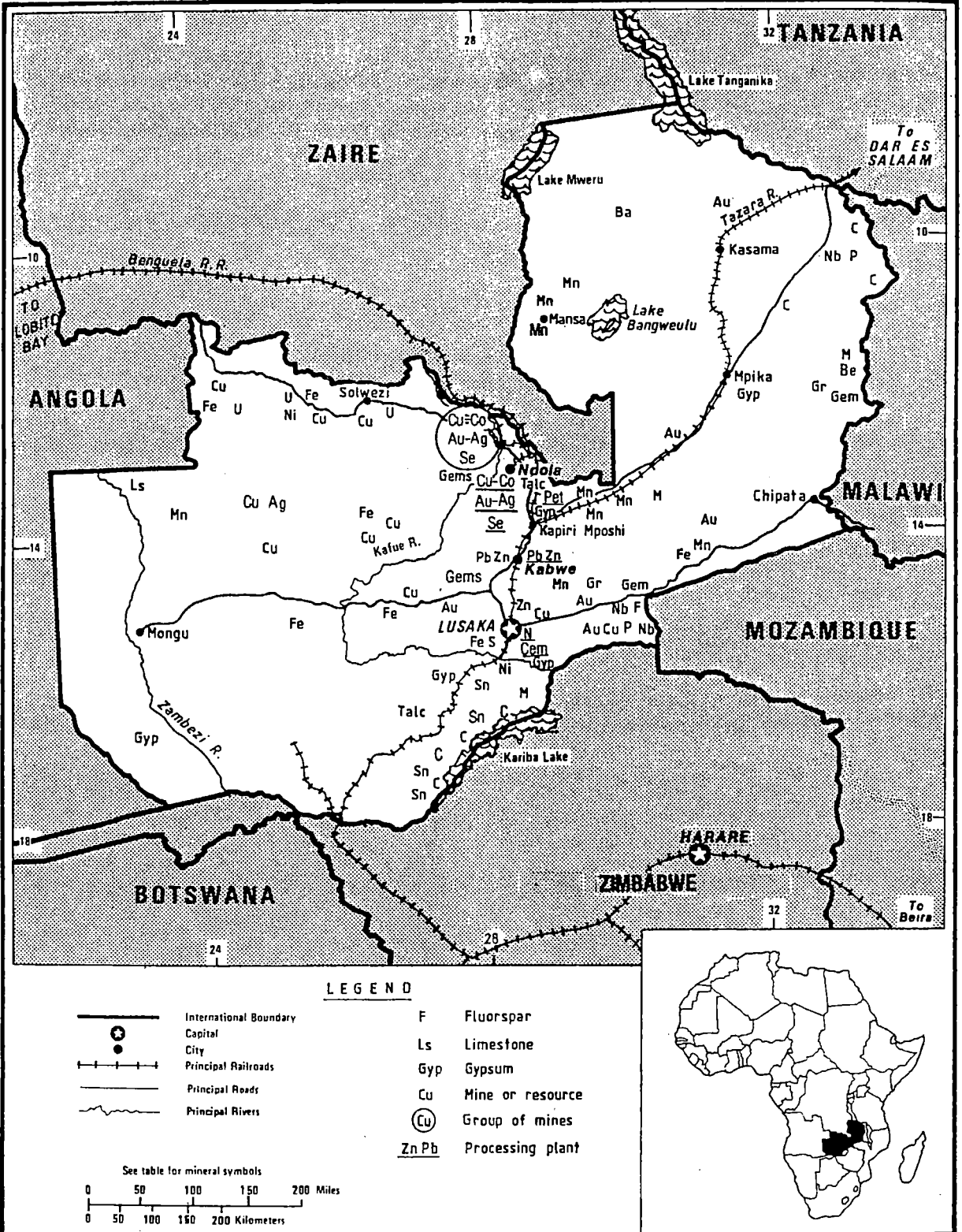
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ZAMBIA

AREA 753,000 sq km

MINERALS



Source: USBM 1984

M155

Introduction

History

Ancient iron smelting most probably began in Zambia at the beginning of the first millennium by the Bantu speaking iron-age peoples. Copper was mined and smelted in numerous locations as is borne out by the many ancient workings on oxidized deposits particularly in the Katanga (Shaba) area of Zaire. There are fewer ancient workings on the Zambian side of the Copperbelt as most of the outcrops were leached of copper. Kanshansi and Bwana Mkubwa had important ancient workings on oxide (usually malachite) deposits¹.

By the 16th Century copper was being extensively traded as ingots in the form of a St Andrews Cross. The first written reference to mining on the Copperbelt was in 1591 by Filippo Pigafetta in Rome based on information from a Portuguese traveller, Odoardo Lopez². The ingots were traded via the Arabs on the east coast who had trading outposts as far down as Sofala (Beira). This lucrative trade in copper, gold, ivory and slaves was later taken over by the Portuguese.

When the first Europeans arrived in the area at the end of the last century copper mining had almost ceased except for a few workings in Katanga. It is estimated that over 100 thousand tonnes of copper from one million tonnes of ore was produced from the ancient Katanga workings. The ancient mines were limited by the water table and because sulphide ores could not be smelted³.

Following the gold and diamond rushes in the 1870's and 1880's in South Africa, the principal mining magnate, Cecil John Rhodes, started looking north for further mineral deposits to finance his dream of a Cape to Cairo railway. To this end he obtained a charter from the British Government for the British South Africa Company (BSAC) to penetrate the interior and set about obtaining "agreements" from the traditional leaders for mineral rights.

In 1885 the border between the British and Belgian spheres of influence had been defined as the watershed between the Congo and Zambezi River basins, which runs through the middle of the Copperbelt. In the same year the BSAC obtained exclusive rights to minerals in the Rhodesias from Queen Victoria, valid until 1986.

The first colonial mining was at Kabwe on a lead/zinc deposit in 1905. In 1906 the railway reached this mine and concentrates were exported to Britain. Colonial copper mining started in 1908 with the first commercial production at Kansanshi, then in 1911 at Sable Antelope and in 1913 Bwana Mkubwa produced its first concentrate.

In 1922 company rule ended, but it retained its mineral rights and royalties, and granted exclusive prospecting rights over vast areas to large mining companies to undertake systematic exploration. In 1923 Copper Ventures Limited obtained a concession along the Katanga border. In the same year the Nkana sulphide deposit was discovered and by the late twenties development work was underway on several of the Copperbelt deposits. Rhodesian Selection Trust (RST) was formed in 1928 with British and American capital.

RST later became Roan Consolidated Mines (RCM) with a 20% shareholding by the American Metals Company which later became AMAX Inc. Nchanga Consolidated Copper mines was formed in 1926 as a subsidiary of the Anglo American Corporation of South Africa. RST and the AAC controlled Zambian copper mining via their subsidiaries RCM and NCCM for the next 40 years.

With the onset of the depression in 1929, copper mining and prospecting virtually ceased. In 1931 the companies agreed to cut production by 75% in an attempt to face the crisis and several mines were closed during this period. By 1935 copper prices had rallied and 146 kt of copper was produced. The build-up to and outbreak of World War II rapidly increased demand for copper and by 1940 production had reached 265 kt.

Northern Rhodesia (Zambia) became part of the settler controlled Central African Federation in 1953 and during the copper boom of the fifties it was the principal source of revenue for the grouping. The nationalist movement, the African National Congress (ANC) of Northern Rhodesia, was founded in 1948 and it split into two parties in 1958, the ZANC under Kenneth Kaunda and the ANC under Harry Nkumbula. The next year the ZANC was banned and the United National Independence Party (UNIP) was formed with Kaunda as its leader, which won the first general election in 1962.

Zambia gained independence from Britain in 1964, under UNIP, and it was only a few hours before independence that the state managed to acquire the mineral rights to the country from the BSAC, for four million UKP. But the BSAC had previously granted mining concessions to RCM and NCCM, in the best areas, in perpetuity.

In 1970 the mines were nationalised and the companies were reorganised into Nchanga Consolidated Copper Mines (NCCM) and Roan Consolidated Mines (RCM) with 51% of the shares being held by the wholly state-owned Zambia Mining and Industrial Corporation Limited (ZIMCO) which issued bonds worth 331 MUSD at 6% to the old owners for the 51% holding. The minority 49% of NCCM was held by Zambia Copper Investments (ZCI) owned by Minorco in Bermuda which is in turn owned by AAC and De Beers of South Africa. The 49% of RCM was held by RST International Inc., a subsidiary of AMAX Inc (20%), Security Nominees Limited (12%) and the public (16%).

In 1974 and 1975 the management agreements with AAC and AMAX were terminated and the state bought the issued bonds. NCCM and RCM were established as self-managing companies with Zambian managing directors. At the same time a subsidiary of ZIMCO was created, the Metal Marketing Corporation of Zambia (Memaco), to market all minerals produced in Zambia.

In 1979 the state converted part of its loans to NCCM and RCM into equity, thereby increasing its shareholding to 60% and 61% respectively. In 1982 ZCCM and RCM were merged to form Zambia Consolidated Copper Mines Ltd. (ZCCM) in which the state's holding is 60.3% via ZIMCO⁴. In 1987 the RST 9% holding was bought by a Greek businessman Mr A.S. Sardanis, who had been a government representative on the Boards of NCCM and RCM in the early seventies, after nationalisation.

For Anglo American (NCCM) the Zambian buyout was an important source of foreign currency and a major boost to its international operations. Profits generated in South Africa were difficult to transfer outside the country. In the early seventies Minorco was a "brass nameplate" company in Bermuda, but with the capital injection from the Zambian buyout it became the principal international subsidiary of the Anglo-De Beers group and by 1990 its market value was over 3 billion USD⁵ and it has operations across the globe. Shortly after the buyout, copper prices fell in 1971/2, rose in 1974/5, fell until 1978, rose in 1979/80 then went into the long decline of the eighties. It could be thus argued that the TNCs gave up their share ownership of Zambian copper at an extremely propitious time. In addition, during the mercurial prices of the seventies, they were receiving direct payment for technical and management services to the companies that did not depend on the vagaries of copper prices.

The Economy

Zambia covers 753,000 km² and has a population of about eight million resulting in a low density of only ten persons per km². During the eighties the Zambian economy was in crisis due to the collapse of copper prices. In 1988 it had a GDP/capita of about 344 USD, about half of the 1980 figure. The currency has been drastically devalued over the last decade from 1.26 USD to the Kwacha in 1980, to 25 Kwacha to the USD in 1989. This has also been reflected in the extremely high rate of inflation, 1500% from 1980 to 1989. Gross Fixed Capital Formation (GFCF) as a percentage of GDP is low, at less than 10% of GDP reflecting the economic crisis.

Table 1. ZAMBIA, BASIC ECONOMIC INDICATORS

(Kwacha)	Unit	1980	1982	1984	1986	1988
Population	M	5.9	6.1	6.4	7.0	7.6
Pop. density	/km ²	7.8	8.1	8.5	9.2	10.1
Forex Rate	/USD	.79	.93	1.79	4.17	8.22
CPI (1)		100	128	183	381	847
GDP mp	G	3.1	3.6	4.9	13.0	21.5
GDP/cap	USD	659	635	428	447	344
GFCF (2)	M	558	618	623	1061	
GFCF/GDP	%	18.2%	17.2%	12.6%	8.2%	
Debt (3)	GUSD	2.38	2.63	2.78	5.64	6.50
Debt/GDP	%	61%	68%	101%	181%	305%
Labour Force	k	381	368	365	361	361
Govt Revenue	G	.77	.84	1.09	3.04	

Source: CSO 1989.

The national debt is the highest in the region at 6.9 billion USD in 1989 (204% of GDP), but debt service payments were only 14.2 of exports in 1988 due to a moratorium and rescheduling. But this means that at the present rate of repayment the debt grows without any further new borrowing.

Table 2. ZAMBIA, GDP BY SECTOR (MZKw)

Year	Total GDP	Agriculture	Mining	Manufacturing
1965	649.9	8.2%	42.3%	7.3%
1970	1185.3	7.2%	36.8%	10.4%
1980	3063.6	14.2%	16.5%	18.5%
1985	6332.1	16.8%	9.1%	20.6%
1989	43637	13.6%	12.5%	34.7%

Source: CSO 1974 and 1989, EIU 1990.

The economy is heavily dependent on the mining industry. Although its contribution to GDP has decreased from 42% in 1965 to 9% in 1988 it still constitutes almost all exports. The manufacturing sector expanded rapidly in the sixties and seventies, from 7% of GDP in 1965 to 19% in 1980, but its share of GDP has remained fairly constant in the 1980's.

Declining copper prices have put severe strains on the economy. In real terms the average price of copper in the eighties was only half the average for the first ten years of independence. In addition production has been falling so that Zambia's average real earnings from copper in the eighties have fallen 55% since its independence (1964). Although prices rallied somewhat in 1988 and 1989, they fell again at the end of the year.

Table 3. COPPER PRICES AND ZAMBIAN COPPER EARNINGS
AT CONSTANT 1964 VALUES

Year	US GNP deflator	Price US\$/t	Indexed Price	Export kt	Indexed Exports
1964	100.00	988	100.0	681.0	100
1965	102.19	1316	130.3	683.0	131
1966	105.56	1547	148.3	599.0	130
1967	108.66	1148	106.9	601.0	94
1968	113.54	1252	111.6	643.0	105
1969	119.26	1485	126.1	730.0	135
1970	125.76	1413	113.7	684.0	114
1971	132.03	1087	83.3	635.0	78
1972	134.68	1069	80.3	711.0	84
1973	145.43	1784	124.1	670.0	122
1974	158.25	2053	131.3	673.4	130
1975	172.98	1235	72.2	641.2	68
1976	181.99	1409	78.3	745.7	86
1977	192.59	1310	68.8	666.6	67
1978	206.87	1362	66.7	589.2	58
1979	224.74	1986	89.5	651.8	86
1980	245.65	2187	90.1	661.3	87
1981	268.85	1735	65.3	504.4	48
1982	284.98	1453	51.6	606.6	46
1983	296.10	1585	54.2	550.6	44
1984	306.93	1351	44.6	530.3	35
1985	316.04	1345	43.1	474.5	30
1986	324.31	1367	42.7	436.4	27
1987	334.57	1786	54.0	475.3	38
1988	366.02	2601	71.9	398.2	42
1989	381.11	2866	76.1	440e	49

Source: CSO 1970 and 1989, Shearson Lehman Hutton 1989, Hugh Douglas 1983, USGPO 1990.

The Zambian economy is now having to operate on about 40% of the foreign exchange (forex) that it had in 1970. In an attempt to counter the effects of declining terms of trade the local currency has been drastically devalued since 1982 when the Zambian Kwacha was worth about one US\$. This has resulted in massive price hikes for basic commodities causing high inflation and significant erosion of salaries and wages in the formal sector.

Table 4. ZAMBIA, FOREIGN DEBT AND INDEX OF
WHOLESALE PRICES (selected years)

Year	Foreign Debt GUS\$	Debt Service % of GNP	Debt Service % of Exports	Wholesale Price Index
1970	0.63	37	5.9	100
1980	2.19	61	17.8	284
1982	2.38	66	17.4	320
1984	2.90	136	27.7	508
1987	4.35	228	13.5	2822

Sources: World Bank 1989, CSO 1989.

Since the onset of the decline in mineral export earnings Zambia's foreign indebtedness has increased considerably, from 60% of GDP in 1980 to a staggering 228% in 1987. Due to concessionary debt rescheduling, debt servicing has dropped from 28% of exports in 1984 to 14% in 1987. Foreign disbursed

debt in current USD increased 690% between 1970 and 1987. This was accompanied by rapid inflation reflected in the wholesale price index which increased from 100 in 1970 to 2822 in 1987.

Since 1984 Zambia has had a National Economic Diversification Programme (NEDP) to attempt to reduce the high dependency of the economy on the copper mining industry. The main other national resource is agriculture, but in the first seven years of the NEDP the role of agriculture has not expanded appreciably, particularly as a foreign exchange generator.

Under the IMF economic recovery programme Zambia instituted a foreign currency auctioning system in 1986 which was suspended in 1987 when the value of the Kwacha fell to 0.05 USD. After increases in basic commodity prices (maize meal) provoked riots on the Copperbelt in 1987, Zambia broke with the IMF and debt repayments were pegged at 10% of export earnings, but relations with the IMF were reestablished in 1989 and Zambia is now complying with a new IMF programme, including further devaluations of the currency, cuts in basic commodity subsidies and the lifting of price controls.

Zambia's dependence on South Africa is in general lower than for many SADCC states but is high for imports (15 to 20%), particularly for strategically important mining machinery and consumables, which are often significantly cheaper sourced from South Africa, with shorter delivery times. Less than one percent of exports go to South Africa, though a larger proportion (about 10%) are routed via South Africa. In 1988 the South African Chamber of Mines reported that there were no Zambian migrants on the South African gold and coal mines, and tourism from South Africa is insignificant.

However, some observers consider Zambia's relationship with South Africa to be "...the most complex and apparently contradictory one in the region"⁶ in that although Zambia is a member of the Front Line States, has always supported sanctions against South Africa and has hosted the ANC headquarters and SWAPO Office, South Africa has done comparatively little to directly⁷ destabilise Zambia. In addition South Africa has become Zambia's largest single source of imports. This is because, even more surprisingly, the South African government has been prepared to back exports through both credit and a range of export subsidies⁸.

One reason for this less aggressive stance by South Africa could be that it has used President Kaunda in the past as a mediator and as the South African internal situation worsens, there will be further need for outside mediation in negotiations with the South African democratic forces and that it is "...perhaps important not to antagonise Zambia any further by military action."⁹ A further reason is that, although the mining industry has been nationalised, the Zambian elite is committed to the capitalist system in contrast to Angola and Mozambique who have suffered the most from South African destabilisation.

The Mining Sector

General

Zambia is highly dependent on copper mining, and its by-product cobalt, to the extent that it is virtually a mono-mineral economy. The contribution of metals mining (copper, cobalt, zinc, lead and precious metals) to GDP has fallen from 38% in 1964 to 9% in 1988, while as a percentage of government revenue it has declined drastically from 53% at independence to 7% in 1987 (average 6% 1980-87). Its proportion of total formal employment has remained fairly constant at around 15%.

Table 5. ZAMBIA, METALS MINING - CONTRIBUTION TO GDP, REVENUE AND EMPLOYMENT (%)

Year	Contribution to GDP	Contribution to Govt. Revenue	Contribution to Employment
1964	38	53	18
1968	38	60	15
1972	24	22	14
1976	18	3	15
1980	16	5	15
1984	14	6	15e
1988	9e	7*	14e

estimate, * 1987, Sources: CSO 1989, CISB 1970-80.

In US dollar terms, mineral production per capita, a crude reflection of the mineral intensity of a nation, has fallen from 253 in 1980 to 167 in 1988, while mineral production per miner fell from 24 thousand in 1980 to 15 thousand in 1984 before recovering to 23 thousand in 1988 (15.4 thousand 1980 USD). The contribution of minerals to total export receipts averaged 94% for the period 1980 to 1988 and is almost entirely made up of copper, but due to low mineral profits mining only contributed an average of 6% to government revenue during the eighties.

Table 6. ZAMBIA, BASIC MINERAL SECTOR DATA (Kwacha)

	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	Avg ¹
GDP Mining	M	490	473	382	619	674	1102	2355	2689	2915	
% GDP Mining	%	16%	14%	11%	15%	14%	16%	18%	15%	14%	15%
Mineral Prod.	M	1179	960	861	1251	1527	2688	5793	8391	10425	
Min.Prod/cap	US	253	184	152	161	133	147	200	130	167	
Min.Exports	M	986	903	911	1001	1109	1343	4928	7462	9119	
% Min. Exports		96%	96%	96%	96%	93%	88%	92%	93%	93%	94%
Mining labour	k	63	61	60	58	58	57	57	56	55	
% mining labour		16%	16%	16%	16%	16%	16%	16%	15%	15%	16%
Min.Prod/lab.	kUS	23.7	18.1	15.5	17.3	14.6	17.2	24.5	16.9	23.0	
Mining Revenue	M	42	11	0	53	94	129	405	207		
% Mining Revenue		5%	1%	0%	5%	9%	8%	13%	7%		6%

¹Average. Sources: CSO 1989.

Economic Geology

Zambia is located between the Zairean (Congo) and Zimbabwean (Rhodesian) cratons and hence contains both mobile belt and ancient craton features. Precambrian rocks underlie more than two thirds of the land area, which have been affected by several tectono-thermal events resulting in a complex geology¹⁰. Seven structural-stratigraphic domains have been proposed:

1. The Bangweulu Block in the north-east
2. The Kibaran Belt running NE-SW in the east
3. The Katangan Sediments and the Lufilian Arc in the centre north-west
4. The Mozambique Belt in the extreme east
5. The Lower Palaeozoic Sediments
6. The Karoo System in the west and the rift valleys
7. The Barotse Basin in the extreme west.

The oldest rocks are those of the Precambrian Basement Complex underlying the Bengweulu Block, consisting of gneisses, granites and volcanics and contain mineral occurrences of gold, nickel, asbestos, copper, iron and manganese.

These are followed by rocks of the Katangan Complex of late Precambrian age consisting of a

sedimentary sequence of shales, sandstones, dolomites, limestones, quartzites and conglomerates which have undergone only slight structural deformation in comparison to the basement complex. These rocks occur in the centre, the north-west and the south-west and host significant copper/cobalt and uranium deposits in the lower part of the sequence in the well-known Lufilian Arc of the Zambia/Zaire Copperbelt. The Katangan Complex is also the source of the Kabwe lead/zinc deposit in the centre of the country and contains iron and gold as well as industrial minerals such as limestone and graphite.

The Katangan sediments are overlain by quartzites, shales and arkoses of Lower Palaeozoic age in western Zambia and in the mid-Zambezi Valley. Sediments of the Karoo Supergroup comprise a Lower sequence of fine clastics and an Upper sequence of coarser clastics and occur in the Zambezi and Luangwa rift valleys and in western Zambia. The Lower Karoo hosts a substantial coal resource and the Upper Karoo has several uranium occurrences.

The Karoo sediments and volcanics are overlain by micaceous shales of Lower Cretaceous age in western Zambia. Pleistocene to Recent aeolian windblown Kalahari sands mantle much of the Western Province and extensive deposits of alluvium occur in river valleys.

The carbonatite complexes of Rufunsa and Isoka are sources of phosphate rocks and niobium deposits. The numerous gabbro intrusions host a significant nickel mineralisation at Munali, south of Lusaka. The younger Hook granite intrudes the Katangan System and contains a variety of copper-gold-silver deposits and magnetite contact metamorphic deposits.

There are numerous pegmatites which in the Kibaran in the south contain tin, tantalum and niobium. The Mozambique Mobile Belt in the east contains occurrences of gold, graphite and semi-precious stones.

Legislation

The laws governing exploration for and exploitation of minerals are contained in Chapter 329 of the Laws of Zambia, namely the Mines and Minerals Act of 1976. The right of searching for and mining of all minerals is vested in the President, in terms of this Act. To prospect, a reconnaissance or prospecting licence must be obtained. It is valid over a defined area, for a limited time period and for the defined mineral/s only and from this right stems the right to demarcate a proposed exploration area not exceeding 26 km² in size and to acquire an exploration licence for the specific mineral deposit which is initially valid for three years.

To mine the deposit a mining licence must be obtained for the mineral/s within the prospecting or exploration area and is initially valid for a maximum of 25 years, after which it may be extended. For building or industrial minerals a mineral permit must be obtained and is renewable every 12 months. The Act also has extensive regulations pertaining to the safety of mining operations. All of these regulations are administered by the Chief Mining Engineer's Department.

The above Act was principally drafted for large scale base metal mining. In 1984 the Act was amended specifically for small mining operations of industrial, precious and semi-precious minerals to include area charges (on prospecting and mining), utilisation fees (on industrial mineral mining) and licence fees (flat fee per mineral mined).

The Mines and Minerals Act does not cover hydrocarbons and radioactive (nuclear) minerals which have separate acts, the Petroleum Exploration and Production Act and the Prescribed Minerals Act. The main difference between the former and the Mines and Minerals Act is that it makes provision for a Petroleum committee, chaired by the Minister of Mines, to oversee all activities.

hydrocarbon exploration.

Mining companies are liable for income tax at the company tax rate of 45% of their taxable income. All the normal adjustments apply and only the mining specific deductions will be considered here. Prospecting and exploration expenditure is deductible in the year in which it is spent or carried over to income from the subsequent mining operations. Capital expenditure is deductible immediately and the balance over ten years for a lead/zinc mine or twenty years for any other mine, in equal amounts. Mining losses can be carried back against profits for the previous year and any remaining losses are carried forward against future profits.

Mineral tax is not payable for the first five years of operation; after that it operates at the following percentages of taxable income: copper 51%; cobalt, lead and zinc, 20%; amethyst and beryl, 15% and, gold, selenium, silver, bismuth and cadmium, 10%. Mineral tax itself is an allowable deduction in determining the taxable income for income tax. Mineral export tax is set at 10% of the value of exported minerals and since 1985 is deductible for calculating taxable income.

Repatriation of dividends to foreign shareholders is allowed, after the payment of with-holding tax, at the rate of 50% of after tax profits accruing to non-resident shareholders or 15% of external paid up capital, whichever is the lesser. Foreign companies may borrow locally up to the amount that was brought into the country.

Minerals Marketing

Since 1975, all metals marketing has been carried out by the parastatal, the Metal Marketing Corporation of Zambia Limited (Memaco), a subsidiary of ZIMCO. Memaco has two subsidiaries in London, Memaco Services Ltd. and Memaco Trading Ltd. which deal with their trading in Europe. The transportation of metals is carried out by the ZCCM subsidiary Zamcargo Limited. The reason for setting up a state minerals marketing authority when the state already controls the mining industry is unclear, except to save on forex commissions for agents. But firstly, copper is a known commodity, traded on the LME, with low commissions and secondly, it is by no means clear that the forex costs of running Memaco, including their overseas offices, is less than what would have been paid in commissions. However, in the seventies the old owners were making huge profits from marketing the copper, particularly Amax¹¹, and thus the government may have thought that setting up its own marketing authority was the only alternative.

Zambia, as a land-locked country, regularly has problems in transporting its minerals to ports for shipment overseas. The western route along the Benguela Railway to Lobito Bay in Angola has been out of action since 1975 due to South African sabotage and sabotage by the RSA and USA backed UNITA bandits. Since 1974 the new Tazara Railway to Dar es Salaam has been used but this line has had major maintenance problems over the last few years so that the southern route through the RSA to the port of East London has also been used. A small amount of metal is also transported to Dar es Salaam by road by the Zambia Tanzania Road Services (ZTRS), but at a very high cost. It generally takes about three months for the copper to travel from the refinery to the warehouses in Europe. The high value metals are airfreighted (gold and silver).

The majority of Memaco's sales are for copper which is traded at the LME price plus the high grade premium (about 20 UKP). Wirebar production and sales have been on the decline due to a decrease in the demand for this form. The principal markets for Zambian copper are Japan, France, the UK, Italy, West Germany and Sweden. ZCCM owns 50% of a copper rod (CCR) manufacturing company, Societe

de Coulee Continue de Cuivre (SCCC), in France which sells about 170 kt/an of wirerod, produced from Zambian copper.

Memaco appears to be an experienced trader of copper on the world markets and has managed to build up a core of personnel in the difficult field of metals trading who have over the years acquired the confidence of several international customers for the Zambian high grade product. They have a major disadvantage with regard to their competitors due to their long delivery times (about 3 months to Europe) but they appear to have overcome this via copper exchanges to facilitate timely deliveries. Given their experience and overseas infrastructure they could save the other (small) copper producers in other countries of the region much needed forex if they were to market their production for them.

Zambia is a member of CIPEC but this body has never been an effective producer organisation in terms of stemming the declining price of copper mainly due to the large proportion of supply coming from developed countries and their companies¹², and the renegade policies of some third world producers such as Chile since 1973¹³. The 1985 demise of the last effective metal producer body, the ITC, does not augur well for the establishment of CIPEC as an active producer cartel.

Labour

The expatriate mining labour force was 16% of the total in 1964 then steadily declined to 1.5% in 1988 and has further declined since then. This reduction has come about principally due to a rapid increase in mining company in-house training programmes since independence. In 1989 there were 181 ZCCM employees on sponsorship and a further 210 Zambian students on company scholarships in Zambia and overseas¹⁴. The creation of the School of Mines at the University of Zambia in 1971 has also increased the number of Zambian professionals in the mining industry.

Table 7. ZAMBIA, MINING EMPLOYMENT

Year	Copper(cobalt)			Lead/Zinc			Total	% Expat
	Zambian	Expat.	%	Zambian	Expat.	%		
1964	39203	7326	15.7	1828	490	21.1	48847	16.0
1968	43198	4845	10.1	2118	366	14.7	50527	10.3
1972	46245	4600	9.1	2175	295	11.9	53315	9.1
1976	53082	4060	7.1	2744	224	7.6	60110	7.1
1980	55258	2485	4.3	2593	123	4.5	60459	4.3
1984	na	na		na	na		58104	3.1
1988	na	na		na	na		55000e	1.5

Sources: CISB 1968-80, ZCCM 1989, CSO 1989

In 1983 the average earnings in the mining industry were 4129 ZK per year, 43% more than for industry as a whole, but due to the crisis in mining the gap has since narrowed. Within the mining industry the ratio of Zambian to expatriate earnings was 1:2.7, compared to 1:4.7 in 1970, mainly due to a significant increase of Zambians in professional and managerial positions rather than a relative increase in the wages of workers. From 1970 to 1983 average annual earnings of Zambian miners increased by 269% in current terms but as inflation was about 410% over the same period, earnings fell by 45% in real terms. Since then wage increases have lagged well behind inflation so that in real terms earnings have fallen substantially, especially since forex auctioning was introduced at the end of 1985 which provoked a massive devaluation of the currency and runaway inflation.

Fatalities per thousand workers fell steadily from 1956 to 1974 by 50%, but since then have remained fairly static at around one death per 2000 workers. Serious injuries per thousand workers dropped by 47% from 1964 to 1982. From 1982 the rate has remained constant at about 32 per 1000 workers. The

two principal causes of fatalities were the handling of equipment and rock falls. With increasing production from opencast and tailings retreatment, the incidence of accidents is likely to fall.

In the early years of copper mining, most of the labour was migrant and unskilled¹⁵, and mining was labour-intensive and unmechanised. The "white" expatriate labour was permanent and held all the skilled (artisanal), professional and managerial positions while the "black" labour was migrant and filled only unskilled and semi-skilled positions. However, from the 1960's there was an increasing tendency towards a more settled labour force with concomitant increase of skill levels and mechanised mining methods. Foreign migrant labour peaked in the 1955-59 period at 16 thousand/annum (mainly Tanzanian and Malawian) representing 27% of the total labour force¹⁶ of 57 thousand. By 1980 the labour force was 63 thousand and almost all permanent.

The first miners strikes took place in 1935 in response to a unilateral increase in taxation by the colonial government and was not broken before six miners had been killed. In 1937 a white miners union was formed to attempt to maintain white privileges and to stem the advancement of the black workers into "white" jobs.

The first African trade union was formed in 1948 and by 1949 the Northern Rhodesia African Mineworkers Trade Union had branches across the Copperbelt. Its main focus was on removing the racist job barriers which were supported by the white union and instituting a non-racial system of equal pay for equal work. In 1955 the African union went on strike on the issue of wage increases and the demand for a closed shop. The turnout was virtually 100% and the strike lasted 58 days before the companies agreed to their demands.

The racist job barriers were only dismantled in 1963, a year before independence. The last racial union, the Zambia Expatriate Mineworkers Union, was dissolved in 1969. The Mineworkers Union of Zambia (MUZ) was formed in 1967 by a merger of the old union with the staff and mine police associations.

During the period of high copper prices up to 1975, MUZ made significant advances in improving the real wages and working conditions of its members, but since 1975 the mining companies have had negligible surpluses due to the falling real price of copper and the MUZ has been unable to halt the steady decline of the living standards of its members.

In 1985 there was an unofficial strike over the deduction at source of pensions. The strike only had a turnout of about 30% after the first day and was essentially a failure, especially in terms of the Union as, after government intervention, membership was made voluntary rather than automatic resulting in a 25% loss of union dues.

Given the fact of the declining profitability of copper mining and that miners are still substantially better off than workers in general (300% better than agricultural workers in 1983), it is unlikely that MUZ will be able to halt the declining real earnings of its members.

ZCCM

Zambia Consolidated Copper Mines (ZCCM) accounts for all of Zambia's copper, cobalt, lead, zinc and pyrites production. The company is 60% state owned via the state holding company Zambia Mining and Industrial Corporation (ZIMCO). The only significant minority shareholding is 27% held by Zambia Copper Investment Ltd. which is owned by Anglo American and De Beers of South Africa via their subsidiary Minorco in Luxemburg.

In 1982 Nchanga Consolidated Copper Mines and Roan Consolidated Mines were merged to form

ZCCM. RCM and NCCM had been the major companies from the beginning of large scale copper mining in the early 1930's.

In 1971 long-term debt represented 7% of total capital employed but with the fall in copper prices in 1975 this proportion rose to 20% and the debt became increasingly foreign denominated. By 1989 98% of the long-term debt was foreign, most of it in US\$ (50%) and had increased to 35% of capital employed¹⁷.

Profits have also reflected the value of copper on the world market and have slumped since 1975 except for 1980 when the price of cobalt (a major by-product of copper production) shot up and in 1988/9 when the price copper improved. Profits as a proportion of sales averaged 36% between 1971 and 1975 but had fallen to 2% over the period 1982 to 1989 and were only 6% of capital employed for the entire period (1971 to 1989)¹⁸.

Table 8. ZCCM: FINANCIAL PROFILE (constant 1981 MUSD)

	Sales	Capital	Profit ¹	Tax	P/C ²	Div ³	Debt	Int ⁴	Cost ⁵
1971	935	757	404	200	27%	102	50	1	84
1972	755	882	224	60	19%	80	111	3	84
1973	936	1095	285	81	19%	105	153	9	78
1974	1493	1217	775	477	24%	172	183	11	71
1975	1161	1497	277	136	9%	37	285	12	77
1976	859	1750	-90	-84	-0%	0	360	39	81
1977	1028	1511	83	54	2%	0	314	42	67
1978	808	1296	-75	-48	-2%	0	244	40	60
1979	1116	1688	126	13	7%	6	267	48	61
1980	1329	1715	284	112	10%	29	234	39	68
1981 ⁵	1312	1852	42	-26	4%	11	337	50	83
1982	1001	1505	-145	3	-10%	0	494	48	85
1983	739	1284	-93	3	-8%	0	477	45	62
1984	771	1012	52	52	0%	0	438	61	52
1985	673	1467	52	52	0%	0	410	53	46
1986	492	1819	36	43	-0%	0	495	38	34
1987	633	2001	19	70	-3%	0	563	72	49
1988	1091 ⁶	1457	59	25	2%	0	501	62	62
1989	1228 ⁶	1173	184	60	11%	9	408	51	58

¹ pre tax, ² final profit/capital, ³ dividends, ⁴ interest payments, ⁴ real US cents per lb Cu (cost of own sales/copper production), ⁵ For 1971-81 the US\$ Manufacturing Unit Value Index deflator was used and from 1982-89 the US GNP deflator was used, ⁶ including sales of metals bought-in and delivered to its customers by an associated company. Sources: Radetzki, 1985 (1971-82), ZCCM, 1989 (1983-9).

The low real costs per pound of copper produced from 1977 to 1980 are principally due to the devaluation of the Kwacha in 1976¹⁹. Unit costs then rose for 1981 and 1982 before falling to an all-time low in 1986 due to rapid devaluations of the currency from 1981, but then rose slightly in 1988 and 1989. This rise is partly due to the fact that the cost/lb is calculated by dividing the total cost of sales by copper production only. If the cost of producing cobalt, lead, zinc and other by-products was included, the unit cost for copper would be substantially lower. In 1985 the cost of copper production made up 92% of the total cost of all production.

ZCCM has managed to remain profitable in the face of falling real copper prices by drastically reducing the real wages of workers which have not kept up with the high inflation rate in part caused by the devaluation of the national currency.

Metals brought-in and delivered to customers by an associated company have become a major proportion of sales and in 1988/9 constituted 34%, up from 22% in 1987/8. This is done to fulfil prior contracted supply commitments.

From 1983 a Mineral Export Tax was introduced and is charged on the gross amount received from sales of all minerals exported, irrespective of the company's profits. Initially this levy was 4% of exports but was increased to 8%. This system meant that ZCCM would have had to pay taxes in excess of profits unless the net profit before tax exceeded 30% of turnover. After representations to government the Income Tax Act was amended in 1985 so that the Mineral Export Tax was allowed as a deduction in the calculation of mineral and income taxes, but at the increased rate of 13% of exports²⁰. In an attempt to rehabilitate the company, it has been exempt from Mineral Export Tax from January 1988²¹.

In January 1986 the company announced a "survival plan" which entailed the closure of Kansanshi mine, Chambishi mine, number 3 shaft at Konkola, the Luanshya smelter, the Ndola refinery tank-house and two concentrators. These closures will result in the laying-off of about 3000 workers. This plan arose out of the results of two studies done by outside consultants in 1985 on ZCCM. According to these studies ZCCM is a viable enterprise if it is allocated the foreign exchange it requires to operate and if it is allowed to trim unprofitable operations²².

Since the late seventies the company has not been able to get the necessary foreign currency to operate efficiently, resulting in the deterioration of plant and machinery and higher operating costs. The government is unable to give the company the foreign exchange that it needs (about 40% of earnings) due to the requirements of the rest of the economy. It appears that the company has decided to drop the more costly operations and to concentrate its limited forex on the most viable operations in order to bring itself back to profitability. In this manner overall output will remain constant by increasing the production of the remaining operations.

The company plans to keep cobalt and copper production steady at about 4-4.5 kt/an and 450-470 kt/an respectively and to reduce staff levels to 53,000 with 800 expatriates²³.

Mineral Production

General

Table 9. ZAMBIA: METAL PRODUCTION & EXPORTS, AVERAGES FOR 1964-88.

Metal	Cu	Zn	Pb	Co	Coal
Avg. Production kt	617	41.0	16.3	2.54	601
% mineral prod.	88%	2.4%	0.7%	4.1%	1.3%
Avg. Exports kt	613	39.4	13.6	2.25	nap
% tot. exports	90%	2.5%	0.7%	2.6%	nap

Source: CSO 1974, 1989

s. Over the same period copper averaged 90%, zinc 2.5%, lead 0.7% and cobalt 2.6%. Copper exports peaked in 1976 at 746 kt and have steadily fallen since then to 398 kt in 1988. Zinc and lead exports both peaked in 1972 at 60.6 and 26.7 kt respectively. By 1988 zinc exports had fallen to 19.2 kt and lead exports had dropped to 3.7 kt. Cobalt exports on the other hand have been increasing and in 1988 5171 tonnes left the country, accounting for 6% of total exports.

Zambia's share of world copper output has fallen steadily since 1960, by 64% from 13.6% to 4.9%. It was never a world league producer of either zinc or lead, but is a major world producer of cobalt. In 1988 Zambian cobalt production constituted 16% of world output, and with neighbouring Zaire, about half of global production.

Table 10. ZAMBIA: SHARE OF WORLD MINE PRODUCTION.

Year	World Copper	Zambia Copper	% Copper	World Zinc	Zambia Zinc	% Zinc	World Lead	Zambia Lead	% Lead
1960	4243	576	13.6	3351	34	1.0	2376	16	0.7
1964	4859	632	13.1	3987	52	1.3	2570	15	0.6
1968	5476	685	12.5	5120	59	1.2	3034	24	0.8
1972	7045	718	10.2	5822	56	1.0	3556	26	0.7
1976	7873	709	9.0	6222	37	0.6	3475	14	0.4
1980	7837	596	7.6	6213	33	0.5	3566	10	0.3
1984	8130e	521	6.4	6742	29	0.4	3386	9	0.3
1988	8700e	422	4.9	7100	20	0.3	3400	6	0.2

Sources: CSO 1970 & 1989, BGS 1989.

Although the Zambian minerals industry is dominated by copper, a variety of other minerals are produced. The main by-products or co-products of copper mining are cobalt, selenium and gold while silver and, in the past, cadmium are by-products of lead/zinc mining. In addition several other minerals are produced for copper mining and refining such as coal, pyrite and lime. Finally there is some small scale mining independent of the copper industry such as manganese, talc, emeralds, beryl, feldspar and phyllite.

Table 11. ZAMBIA: SELECTED MINERAL PRODUCTION.

Mineral	Unit	1970	1975	1980	1985	1986	1987	1988	1989	%Chg ¹
Cassiterite	t	na	na	na	na	3.1	24.1	1.9	1.8	
Coal	kt	623	898	569	511	557	463	524	395	-37%
Cobalt	kt	2.05	1.84	3.31	4.42	4.34	4.48	5.03	4.49	119%
Copper	kt	683	640	610	480	460	483	422	451	-34%
Emeralds	t	na	na	na	.12	.41	.99	1.04	.33	
Feldspar	kt	na	1.17	.48	.19	.21	.05	.12	.02	
Gold	t	.170	.501	.329	.350	.058	.350	.262	.149	-12%
Lead	kt	27.3	19.1	10.0	8.0	6.6	8.0	6.4	3.9	-86%
Limestone	Mt	na	.755	.698	.702	.705	.720	.999	.775	
Cement	kt	na	na	310	316	334	375	405	386	
Lime	kt	na	na	182	256	243	235	239	230	
Manganese	kt	na	na	.38	.98	.55	.00	.50	.35	
Pyrite	kt	na	19.0	3.2	28.3	19.2	45.4	67.5	60.1	
Selenium	kt	na	36.5	22.7	19.5	22.1	27.1	24.4	21.4	
Silver	t	47.8	31.1	23.8	18.9	26.8	29.9	29.3	19.8	-59%
Talc	kt	1.3	.0	.0	9.5	.3	.3	.1	.1	-89%
Zinc	kt	53.5	46.9	32.7	22.9	22.5	21.0	20.2	12.9	-77%

¹ % change 1970-89.

Source: Ministry of Mines 1990.

Copper (Cobalt)

From the commencement of large scale mining in the 1930's to 1988 about 1,1 Gt of ore grading roughly 2.7% Cu have been treated yielding about 25 Mt of copper and 89 kt of cobalt. In 1985 reserves and resources were estimated at 1.6 Gtonnes grading on average 2.55% Cu and in 1989 proven reserves were estimated at 421 Mt grading 3.17% Cu, which means that the average grade treated over the next 18 years will be roughly 2.2% Cu, assuming a dilution factor of 30%²⁴. However, in 1975 reserves stood at

828 Mt grading 3.1% Cu and by 1989 half (48%) had been mined leaving a balance of 421 Mt grading 3.2% Cu which will last until the year 2005, assuming an annual depletion rate of 25 Mt. Since 1975 407 Mt of ore have been extracted which would leave a theoretical balance of 422 Mt in 1989. As the actual balance is 421 Mt, it would appear that there has been no delineation of new reserves in the last 14 years.

Table 12. ZCCM: COPPER & COBALT RESERVES ²⁵

Mine	31 March 1975				31 March 1989				% Change ²
	Ore Mt	ore x %Cu	grade	%Co	Ore Mt	ore x %Cu	grade	%Co	
Nchanga	252.3 ³	3.42	8.63	na	118.46	4.00	4.74	.58	-45% ⁴
Mufulira	143.9	3.15	4.53		67.95	3.17	2.15		-52%
Nkana	119.9 ³	2.44	2.93	na	100.73	2.34	2.36	.14	-19% ⁴
Luanshya	72.1	2.56	1.85		33.68	2.47	.83		-55%
Baluba	64.4	2.62	1.69	.16	42.47	2.50	1.06	.17	-37%
Chibuluma	8.4	4.58	.38		8.81	3.29	.29		-25%
Chambishi	42.3	2.91	1.23		shut				-100%
Konkola	125.1 ³	3.55	4.44	na	48.59	3.90	1.90	.07	-57% ⁴
Total:	828.4	3.10	25.68	420.69	3.17	13.33			-48%

¹ total reserves, ² Cu metal content, ³ as at 31 Dec 1974. ⁴ The old NCCM definition of reserves is different to that of ZCCM. Sources: NCCM 1975, RCM 1975, ZCCM 1989.

In addition to the above reserves, ZCCM geologists have estimated that resources of copper amount to a further 30 million tonnes of metal within the company's existing Copperbelt Mining Licence areas, but these are generally deep and/or low grade and/or in difficult ground and/or are difficult to treat. Thus much of the resources may not be economic to mine, depending on prices and technological improvements. Nevertheless they would add at least 5 to 10 years to the 15 to 20 year life of the reserves. In addition there are a few, smaller, copper deposits away from the Copperbelt, particularly in the north-west.

In general about 25 Mt of ore grading on average about 2.2% copper are mined annually from both open pit and underground operations. The ore then goes to the concentrators where it is crushed and milled before going to flotation cells to produce several concentrates. The sulphide concentrate (25 to 45% Cu) is then mixed with limestone and smelted in reverberatory or electric furnaces producing a matte which goes into converters to remove the iron and sulphur, resulting in blister copper (about 99.8% Cu) which is then cast into anodes ready for electro-refining.

The cobalt concentrate is sent to the Cobalt Plants at Nkana or Chambishi for refining into pure cobalt. The high grade oxide concentrates (12% Cu) are acid leached at the Nchanga High Grade Leach Plant (HGLP) where the copper is recovered by electro-winning. The tailings leach plants (TLP) treat current and old tailings and low grade liquor from the HGLP. The copper is recovered by electro-winning, producing cathodes which are then further refined by poling to remove the oxygen before being cast into high grade wirebars.

The blister anodes from the smelters are electro-refined onto copper starter sheets producing high grade cathodes ready for export. Sulphur is recovered from the converter chimneys at Nkana and Chambishi for the production of acid for electro-refining and leaching, but the lower concentration sulphur emissions from the reverberatory furnaces are released into the atmosphere.

Table 13. ZCCM, COPPER ORE TREATED AND GRADE

Year	Nchanga ¹		Mufulira		Nkana		Luanshya ²		Other		TOTAL	
	Mt	% ³	Mt	% ³	Mt	% ³	Mt	% ³	Mt	% ³	Mt	% ³
1972	10.2	3.72	5.9	2.15	5.6	1.78	6.3	1.55	5.2	3.36	33.2	2.65
1974	9.8	3.45	7.1	2.17	5.5	1.66	7.1	1.38	6.4	3.04	35.9	2.46
1976	9.6	3.61	6.6	2.36	4.8	1.61	6.1	1.45	5.7	3.08	33.1	2.57
1978	9.1	3.34	6.3	2.31	4.2	1.55	5.7	1.55	5.9	2.78	31.2	2.46
1980	9.1	3.33	5.7	2.10	4.2	1.53	5.9	1.44	6.4	2.27	31.2	2.29
1982	9.8	2.85	5.7	1.86	4.1	1.47	6.0	1.41	6.4	2.29	31.9	2.18
1984	10.4	2.84	4.4	2.13	3.9	1.61	5.5	1.44	5.3	1.93	29.5	2.15
1986	9.7	2.60	4.0	2.10	3.5	1.40	4.9	1.40	3.9	2.20	26.0	2.09
1988e	8.9	3.09	4.8	1.97	3.3	1.38	4.4	1.57	1.7	2.60	23.1	2.19
% ⁴	39%	21%	14%	19%	7%	100%						

¹ including Chambishi, ² including Baluba, ³ % metal content, ⁴ % total production in 1988. Source: CSO 1989, ZCCM 1989.

The average grade treated has steadily fallen from 2.65% in 1972 to 2.19% in 1988, representing a drop of 17% over 13 years. The gross tonnage of ore milled has also fallen, by 11% over the same period.

Before 1985 ZCCM had seven operating divisions, namely Nkana, Nchanga, Mufulira, Luanshya, Kalulushi, Konkola and Kabwe and in that year Kalulushi Division was dissolved and its mines were incorporated into Nkana and Nchanga divisions and in 1986 Konkola Division was incorporated into Nchanga. Hence there are now five divisions, namely Nchanga (Nchanga, Konkola and Chambishi mine), Nkana (Nkana, Chibuluma and Chambishi cobalt and acid plants), Luanshya (Luanshya and Baluba), Mufulira and Kabwe (Kabwe and Nampundwe). This reduction of divisions is a reflection of the overall reduction in copper output (down 40% from 1976 to 1989).

Table 14. ZCCM, COPPER SMELTER AND LEACH PLANT PRODUCTION

Smelter/Plant	1972/3		1988/9	
	Copper (kt)	% Recovery	Copper (kt)	% Recovery
Mufulira Smelter	156.8 ¹	94.6	159.7	96.6
Nkana Smelter	308.9 ²	94.0	149.2	94.6
Luanshya Smelter	117.5 ¹	94.1	nap	-
Nchanga HGLP	104.4 ²	82.7	20.0	48.3
Nchanga TLP	nap	-	97.7	61.5

¹ Year ended 30:06:73, ² Year ended 31:03:73. Sources: NCCM, 1973; RCM, 1973; ZCCM, 1989.

The copper refineries are located at Mufulira and Nkana and the cobalt plants at Nkana and Chambishi. In addition there is a Precious Metals Plant at Ndola which is administered by Mufulira Division. The Precious Metals Plant produces selenium (about 25 t/an), silver (about 25 t/an) and gold (about 300 kg/an), all of which is exported. The plant could also treat the slimes from other refineries in the region such as Alaska and Eiffel Flats in Zimbabwe, but these are currently being sent outside the region.

The proportion of copper production from the leaching of tailings has steadily increased from zero in 1970 to 20% in 1981/2, to 28% in 1988/9 and is expected to rise even further. Excess refining capacity is being used to treat blister from Zaire, and the Mufulira smelter has treated Zairean concentrates on a toll basis. Small quantities of concentrate are also toll treated for small scale operators. There is also the possibility of ZCCM treating the future gold/silver/copper matte from the Kahama deposit in

Tanzania, if its development goes ahead.

Table 15. ZCCM, COPPER REFINERY, COBALT PLANT AND PRECIOUS METALS PLANT PRODUCTION

	1972/3	1982/3	1988/9	% Change ¹
Copper (kt)				
Mufulira	274.1 ²	220.5	198.0 ³	-28%
Nkana	315.9 ²	156.1	155.3	-51%
Ndola	133.2	106.2	shut	-100%
Cobalt (tonnes)				
Nkana	2137	419	2373	+11%
Chambishi	789	1793	2498	+217%
Precious Metals Plant				
Selenium (t)	na	22.1	24.1	+9%
Silver (t)	na	27.5	24.1	-12%
Gold (kg)	na	371	227	-39%

¹ % change from 1972/3 to 1988/9, except for precious metals (1983-89),
² year ended 30/06, ³ including 28.9 kt toll-refined. Sources: RCM 1973, NCCM 1973, ZCCM 1983 & 1989

Lead & Zinc

Kabwe mine comes under Kabwe Division and used to be known as Broken Hill due to its similarity to the Australian deposit and once was one of the highest grade lead/zinc mines in the world. Mining started in 1906 making it the oldest operating mine in Zambia. Lead and zinc are produced with silver and, in the past, cadmium as by-products.

In the concentrator the sulphide ores are floated off and go to the Imperial Smelting Furnace (ISF) and the oxide tailings are dumped and later batch leached. The ISF produces low grade zinc (Zn4) and lead bullion which is further refined in drossing kettles resulting in high grade lead (99.9999%) and a small amount of silver. The old dumps grading 12% to 15% Pb plus Zn are processed in two Waelz Kilns and lead and zinc clinker are extracted from the fumes. The lead goes to the ISF and the zinc is leached then electro-won with the leached concentrator tailings to produce high grade zinc (Zn2) for export.

Table 16. KABWE DIVISION LEAD & ZINC, PRODUCTION PROFILE

Production	1972/3	1982/3	1988/9	%Change
Ore Milled (kt)	355	210	133	-63%
Grade (% Zn)	21.8	25.0	9.0	-59%
Grade (% Pb)	11.1	11.0	18.9	+70%
ISF ¹ Lead Bullion	34.2	21.3	11.7	-66%
ISF ¹ Zinc (Zn4 kt)	32.0	28.4	12.4	-61%
EZP ² Zinc (Zn2 kt)	23.8	11.7	6.1	-74%
Refined Lead (kt)	30.3	15.2	9.1	-70%
Silver (t)	0.0	3.06	3.43	nap
Cadmium (t)	16.24	0.0	0.0	-100%

¹ Imperial Smelting Furnace, ² Electrolytic Zinc Plant. Sources: NCCM 1973, ZCCM 1983 and 1989.

The main ore body is almost mined out and the possibility of treating the dumps using Australian Siros melt technology to produce 2 kt/an of lead for the local market is being investigated²⁶. A project to identify possible sources of lead/zinc from deposits in neighbouring countries was not fruitful. There are known deposits at Mpande in Tanzania and Copper Queen in Zimbabwe. Alternative industries to replace mining are also being considered including the possibility of setting up an aluminium refinery.

based on cheap local energy and imported alumina and a small iron and steel works has also been proposed.

Coal

The coal mining company, Maamba Collieries, is a wholly-owned subsidiary of the State holding company, ZIMCO. It is an opencast operation working the coal seams of the Karoo System on the Zambezi Valley (graben) in the south-east of the country. Mining started in 1966, but production has declined since 1973 when 940 kt were produced, due to falling demand from its main customer, ZCCM. Current production is at the rate of about 400 kt/an of which a small amount is exported to customers in the region (Malawi, Tanzania and Zaire).

The deposits only contain steam coal with almost no coking properties, making it necessary for ZCCM to import coke from Wankie Colliery in Zimbabwe. A comprehensive techno-economic study of the operation was been undertaken by outside consultants²⁷ funded by the World Bank and a rehabilitation project, with assistance from the African Development Bank, has been implemented to restore productive capacity. Proved coal reserves at Maamba are estimated at 70 Mt with a further 18 Mt classified as probable, adequate at current exploitation rates for 150 years.

Sulphur (Pyrites)

Kabwe Division also runs the Nampundwe pyrites mine west of Lusaka. The pyrites is used for the production of acid at the Nkana Acid Plant and some (about 3 kt/m) is sold to Nitrogen Chemicals of Zambia (NCZ) for the same purpose. Reserves are estimated at 8.6 Mt grading 16.3% sulphur. The mine produces about 75 kt/an of pyrite concentrate from about 300 kt/an of ore. A small amount of copper concentrate is also produced.

However, the bulk of sulphur production comes from the chimneys of the copper converters on the Copperbelt. The Nkana Acid Plant produces about 200 kt/an of acid and the Chambishi Acid Plant about 80 kt/an. The installation of a new Chilean (El Teniente) converter at Nkana plus the rehabilitation of the Nkana Acid plant should increase production to 250 kt/an. All the acid is used by ZCCM, principally for tailings leaching.

There is an overall acid shortage in the region and it is hoped that Zambia will be in a position to export once the Nkana Plant is refurbished. Zimbabwe has an acid shortage and the development of the Kanyemba uranium/vanadium deposit in the Zambezi Valley would require a cheap source of large quantities of sulphuric acid to treat the ore.

Tin

A small quantity of tin is mined in the Choma Tin Belt of southern Zambia from pegmatites and related eluvial placers. Reserves are estimated at 215 tonnes of cassiterite in widely scattered small deposits. It has been mined since 1935 and in 1989 production was 1.75 tonnes of cassiterite concentrate. Non Ferrous Metal Works in Ndola produces a small amount of low grade tin metal for the manufacture of solder, but the quality is not high enough for tin plating.

In addition to cassiterite (tin), the pegmatites also contain columbite (niobium) and tantalite (tantalum). The Kamativi Tin Mine across the border in Zimbabwe, is also based on a pegmatite, but in addition to its own production its smelter takes cassiterite/tantalite feed from small operators on surrounding pegmatites and is running below capacity. The possibility of sourcing feed from the Choma Tin Belt would therefore appear to warrant further investigation.

Other Minerals

Several other minerals are exploited in Zambia, the principal ones being limestone, manganese, magnetite, felspar, talc, phyllite, emeralds, beryl and other semi-precious stones. In 1988 there were fifty-five companies and cooperatives holding eighty-two Mining Licences and twenty-one Building Licences (for stone, sand, limestone and clay).

Manganese ore was produced until 1968 at the rate of roughly 50 kt/an and is still exploited on a small scale in the north of the country for the manufacture of batteries by Mansa Batteries Ltd. Reserves in Luapula and Central Province are estimated at some 1.5 Mt grading from 45% to 86% MnO_2 scattered over nine deposits. The other main area is the Kabwe-Mkushi area, but unsurveyed deposits occur over most of the country. Trial shipments have been made to Zimalloys (an AAC company) in Zimbabwe for the manufacture of ferromanganese for the steelworks (Zisco). Zimbabwe currently imports manganese ore from South Africa.

Amethyst is mined by Mindeco Small Mines Ltd, International DGC Mining Company and Lonrho on small operations in the Southern Province near Kariba and Kalomo. Production in 1989 was 6275 kg. Emeralds are mined by Kagem limited from several small-scale operations. Official production was 1214 kg in 1989, but large quantities are mined illicitly and smuggled out of the country.

Felspar is also mined by Mindeco Small Mines at Namukombo who are also small scale producers of limestone (Michinga), tourmaline (Nyimba) and magnetite (Namatobwe).

In 1989 775 ktonnes of limestone was quarried from which 239 kt of lime and 405 kt of cement were produced by Ndola Cement and Chilanga Cement, for the local construction and metallurgical industries. Ndola lime was tested by Zimalloys in Zimbabwe for suitability as a flux for ferrochrome manufacture, to replace burnt lime imports from South Africa, but the phosphorus content of the Zambian product was too high.

Interest has recently been shown in the Munali nickel deposit south-east of Lusaka by Outokumpu Oy (Finland) and also by Bindura Nickel Corporation (BNC, an AAC company) in Zimbabwe. BNC's is facing a future shortage of ore, due to the depletion of reserves at its own mines, and is looking for alternative sources of ore or concentrate. The Munali copper/nickel sulphide deposit was assessed by Zamanglo in the early seventies when the geological reserves were estimated at 11.7 Mt averaging 1.04% nickel and 0.15% copper²⁸. The mining lease is currently held by Apollo Mining, a local earth-moving company.

A substantial high grade fluorspar deposit at Sianyolo on Lake Kariba has been explored by Agip (Italy). Reserves are estimated at 2 Mt and exploitation would be viable for exports if the project did not have to carry the high infrastructural costs (road and power line)²⁹.

Agip have also carried out extensive exploration of a vast low grade uranium deposit with associated copper in the Malundwe and Chimiwungo areas west of Solwezi in the north-west. Copper reserves of about one billion tonnes grading 0.8% Cu with appreciable gold (about 0.2 g/t) have been estimated. Further development is dependent on an improvement in the international uranium price.

Kanshanshi Mine was closed in 1986 but has been reopened to be worked by small scale operators who sell their ore to a ZCCM run concentrator. The ore grades about 3% Cu and has significant gold (about

2g/t) which in fact represents Zambia's largest gold resource. Zambia has many other gold occurrences, particularly in the Luiri gold belt where ZCCM has several dump retreatment operations and the old Matala Mine is being rehabilitated. ZCCM's Small Mines Development Unit reopened the Dunrobin Mine near Mumbwa in 1989 with reserves of 58 kg of contained gold in old dumps.

Zambia has no large high grade iron deposits, but there are numerous small occurrences of ore and there have been projects for the establishment of an iron and steel industry since the early seventies. Studies have been carried out on the Sanje deposit near Lusaka and the Chisasa deposit west of Solwezi. There are also deposits at Pamba Hills, Mutombe, Nagaibwa, Chongwe, Chisama, Nampundwe, Cheta, Shimyoka, Nambala, Kampumba and Chitindulu Hills.

In 1989 an agreement was signed with a Soviet company to investigate the feasibility of setting up a small, 100 kt/an, steel plant³⁰. The ore will come from Nambala, near Mumbwa, and be trucked 280 km by road to a proposed iron and steel plant at Kabwe, in an attempt to avoid the death of the town when the lead/zinc mine finally closes. However, a UNIDO study³¹ on iron and steel in the SADCC/PTA region concluded that basic billet production capacity at Zisco in Zimbabwe was adequate for the whole region, but considering that these would have to be purchased in scarce foreign currency, it may make economic sense for Zambia to develop its own capacity, even though the initial capital costs would also be in foreign currency.

Scaw Foundries of Kitwe smelts scrap in an electric furnace for the production of grinding media for ZCCM, but has regular problems in obtaining adequate feed. The company was purchased by ZCCM from Anglo American in 1988³² and is under rehabilitation.

There are low grade phosphate deposits in carbonatite complexes at Nkombwa Hill at the north-western end of the Luangwa Valley and a group of ring complexes in the Rufunsa area, west of the confluence of the Luangwa and Zambezi rivers (Kaluwe, Nachomba, Mwambuto and Chasweta), which also contain resources of niobium and tantalum. Exploitation of the latter group, for the production of phosphate fertilizer, is still under consideration, particularly Kaluwe which has 6.6 Mt in soils at 5.7% P_2O_5 and 207 Mt in rock at 2.6% P_2O_5 . A syenite deposit near Mumbwe containing apatite is also being assessed as a phosphate source.

As is the case with Dorowa in Zimbabwe, the exploitation of low grade carbonatite deposits only makes sense in strictly national terms, as the final product is likely to cost well above the world market price, but would be available to farmers in local currency. Regional logic would however favour the development of the vast high grade phosphate deposits of Angola (Kindonacaxe and Mongo Tando), Tanzania (Minjinju) and, to a lesser extent, Mozambique (Evate).

Zambia has no hydrocarbons, but interest has been shown in the sedimentary basins. Placid Oil (Hunt Petroleum) drilled in the northern Luangwa Valley in 1987/8, but without result. Mobil Oil did a seismic survey of the south Luangwa valley, but with no follow up drilling, and they plan to survey the southern part of the mid-Zambezi Valley in Zimbabwe, which is shared with Zambia. There is an oil refinery at Indeni outside Ndola which receives crude via the Tazama pipeline from Dar es Salaam.

A United Nations study³³ to determine exploration requirements in 1988 isolated seven areas warranting further work. These were:

The Nkombwa Hill Carbonatite
 The Mumbwa North Apatite
 Peat (as a soil conditioner)
 Serenje Pegmatites
 Lusaka Marble
 Kabwe West Pb/Zn
 Chinyunyu Polymetallics

Infrastructure

The infrastructure along the central spine, going from Livingstone in the south, through Lusaka to the Copperbelt, is good, with rail, road and power lines running all the way. But the vast western and eastern areas are poorly served and the roads that do exist are generally in a bad state of repair. There are international rail connections to Zimbabwe in the south (and on to Botswana, Mozambique and South Africa), Zaire in the north (and on to Angola) and Tanzania in the north-east along the Tazara railroad. Most imports and exports are via Dar es Salaam in Tanzania as the Benguela line to Lobito in Angola is out of action due to South African and UNITA sabotage.

Zambia has hydro power stations at Victoria Falls, Kariba and Kafue Gorge with a capacity greater than national demand. Exports have been made to Zimbabwe, but in 1989 power was imported from Zimbabwe and Zaire due to a fire at the Kafue station. The cost of electricity is one of the lowest in the world.

Any mineral development off the Line-of-Rail would probably require a high initial capital outlay for infrastructure and in fact some viable projects remain undeveloped due to the poor road, rail and power links, such as the Sianoyo fluorspar project and, to some extent, the vast low grade copper and uranium deposits in the north-west.

Several international banks are represented in the country, but in general the financial sector is not well developed and has been severely weakened by the collapse of the national currency and the severe restrictions on foreign exchange. There is no stock exchange.

Local production of inputs to the mining industry is fairly diversified with many of the enterprises coming under the ZCCM. In general there exists a significant ability to manufacture locally a wide range of spares and equipment for the mining industry. The major constraint faced by the companies concerned is the shortage of foreign currency to import the necessary raw materials, especially the various grades of steels.

ZCCM has extensive in-house repair and maintenance capabilities in the divisional workshops and several of the raw materials consumed by ZCCM are produced within the company, by a subsidiary of the company or by a subsidiary of its mother company ZIMCO.

In 1984 ZES (Zambi Engineering Services) carried out a feasibility study for ZCCM on the creation of a factory (Parts Manufacturing Facility) for the manufacture of spares for the mining industry which are presently imported. This new facility will manufacture roughly 800 items that have a large turnover and are of medium to high value. The cost of establishing the factory in 1984 was 127 MZKw (17 MUKP in forex) and it is planned that it will save about 28 MUKP (1984) of forex per annum. The buildings are 90% completed and foreign finance for the equipment is now being sought.

It is apparent that there exists a substantial local capacity for supplying the necessary inputs to mining, but that this resource is under-utilised due to the shortage of imported inputs to these industries, caused by the national shortage of forex which is in turn caused by the rapid decline in the real value of copper over the last decade.

The inability of the mining inputs industries to supply the mining industry with a substantial proportion of its needs has resulted in the ZCCM needing to retain a large part of their forex earnings (about 40%) to finance imports of mining inputs in order to operate efficiently, but due to the forex shortage at the national level the company has only been able to retain about 30% of its export earnings which has resulted in the running down of plant and machinery and lower efficiency and output. This downward spiral has been described by the company as a "self-reinforcing negative process" and the rationalisation plan currently being implemented is apparently an attempt to break out of it, but at the cost of shutting down a significant part of their productive capacity.

Downstream Metal Transformation

The only significant refined copper consumer in the country is Metal Fabricators of Zambia Limited (Zamefa). This company is based in Luanshya and started operations in 1970. It is 51% owned by INDECO (state), 15% by Phelps Dodge (US), 5% by Svenska Metallverken (Swedish), 9.8% by Amax Zambia (US), 9.8% by ZAMIC (AAC) and 9.4% by Continental Ore Resources Limited (local). Both Phelps Dodge and Svenska Metallverken provide management and technical services to the company, the former on the extrusion and rod section and the latter on the wire and cable section.

Zamefa's copper consumption is planned to reach ten kt/ann of cathodes and 80 tonnes of billets, representing about 2% of Zambian refined copper production. They pay ZCCM the high grade LME price for copper minus the transport costs to Europe, estimated at roughly 140 UKP/tonne. They also consume about 300 tonnes per annum of aluminium billets and rod. Small amounts of tin are imported from Zimbabwe after local tin produced by Non-Ferrous Metal Works proved to be unsuitable due to its low quality.

The bulk of their production is continuous cast copper rod (CCR) mainly for export. For this an Outokumpu continuous caster was acquired in 1983, which replaced the previous extruded rod process. Other products include copper cable and wire including telephone cable. Power cable is manufactured up to a limit of 3 kV, but the company is installing plant to produce 11 kV cable.

Almost all of their non-rod output is for the domestic market, although there is some export of telephone cables to the regional market, mainly to Malawi. CCR constitutes 98% of their exports and about 60% of their turnover. The CCR is sold at between 40 and 80 UKP above the LME price for high grade copper. Their main obstacle to increasing exports is in acquiring long term customers. Due to a worldwide CCR excess capacity, customers prefer to shop around rather than to go for long term contracts. It also will take some time before they can become accepted as a reliable supplier.

Their main imports are PVC (Zimbabwe and RSA), armour wire (RSA), plastics (UK), tin (RSA and Zimbabwe), aluminium (RSA), aluminium tapes (Sweden), aluminium casts (UK), jelly fill (Belgium) and graphite (Zimbabwe). Zambia has graphite deposits but these are not being considered as a source at present.

Due to the exports retention scheme (50%) they do not have a problem in getting their forex, but if in fact they use up their full 50% and export CCR at 40 to 80 UKP above the price that ZCCM could obtain

for the cathodes, this would make them a net forex consumer in lieu of the forex lost on the cathodes they consume.

The company has been trying to penetrate the regional (SADCC/PTA) market but with very little success. The main reason for this is that many of the cable consuming power projects in the region are financed by tied aid, but they have also lost open tenders to western countries, partly due the inability of the Bank of Zambia to offer competitive credit facilities. The regional market for copper semis was estimated at 21 kt in 1984³⁴. This would seem to indicate that there is substantial scope for expansion into this market, but it is limited due to the factors mentioned, plus the fact that several of the other states in the region have some copper semis manufacturing capability, especially Zimbabwe where the capacity is possibly superior to that of Zambia³⁵. In addition it appears that both countries are at present expanding their capacity with the regional market in mind. It would therefore be in the interest of regional integration if an organisation like the SADCC were to attempt to rationalise the production of copper semis and manufactures in the region.

A study on the "Production and Exports of Copper Semis in Zambia and South Eastern Africa"³⁶ concluded that Zamefa CCR plant was viable, but that the regional production capacity for extruded products far exceeded demand making it difficult for any one of the companies to operate at a profit and that the regional market for flat-rolled products would only justify a small plant in Zambia if the already existing second-hand mill in Zimbabwe (Radiator & Tinning of Bulawayo) was not able to produce products of sufficient quality.

ZCCM owns 50% of Societe de Coulee Continue de Cuivre (SCCC) in France, a CCR producer, via its wholly-owned subsidiary in the UK, ZAL Holdings Ltd. which also owns ZES. The other 50% of SCCC is held by Thomson Brandt SA of France. The total issued share capital of SCCC is 36 MFF and it produces about 170 kt/ann of CCR, most of which is sold in France.

The logic of this joint north-south venture which generates MVA for a developed country is not immediately apparent, especially as MEMACO's Annual Report for 1985 mentions that SCCC managed to export 40% of its sales "...in spite of the competition from...plants in developing countries"³⁷. Surely then ZAMEFA is one of these plants. There also do not appear to be any benefits by way of acquiring technology as ZAMEFA is receiving technological services from Swedish and American companies rather than Thomson Brandt of France. In addition it does not seem to be a major customer as ZCCM's copper sales to France were only 48% of the tonnage sold by SCCC and only 14% of ZCCM's sales worldwide. One reason for this investment could be to avoid EEC tariffs on copper semis by manufacturing them in Europe.

Discussion

The paramount role of the mining industry of Zambia has been as the capital generator and foreign exchange earner for the development of the rest of the economy. It has provoked virtually no downstream development of metal-based manufacturing industries in its 85 years of existence. Over 98% of refined copper production is exported, while less than two percent is further transformed in the country, of which about half is exported. The national and regional off-take of lead has been increasing over the the last decade, but the lead reserves are almost exhausted. Local consumption of zinc is low and reserves are limited.

From 1964 to 1974, during the period of relatively high copper prices, non-ferrous mining supplied the capital to support a rapid expansion in the manufacturing sector principally for import substitution. It

also generated the forex for the imported intermediate goods and raw materials for these new industries. Due to the high copper earnings between 1965 and 1973 copper mining was able to support an average annual real growth rate of GDP of 3% and real per capita incomes increased by about 20% over the same period³⁸. Manufacturing grew from 6.1% of GDP in 1964 to over 13% in 1974³⁹.

From 1975 copper earnings began to fall and the average annual growth of GDP from 1973 to 1983 was only 0.2%, a decrease of 93% on the preceding decade. The average annual growth of GNP/capita from 1965 to 1987 was negative at -2.1% and the average annual growth of gross domestic investment from 1965 to 1973 was 6.2% but had fallen to minus 12.5% for the period 1973 to 1983 and -9.3 for 1980-87⁴⁰.

Falling terms of trade for copper over the last fifteen years have caused the whole economy to stagnate, bringing into sharp focus the dangers of a development strategy based on raw material exports and the vagaries of the world market. The mining industry of Zambia is vertically integrated into the developed market economies rather than supplying the raw materials for local and regional industry.

An alternative role for the non-ferrous sector would be to provide the basis for a resource-based industrialisation strategy. The local and regional markets are clearly not large enough to absorb Zambia's total copper production even if all imported copper-based products were manufactured in the region, but a significant increase in the production of copper semis and manufactures for export onto the world market would appear to be feasible based on the significant transport cost discount on the LME price for the copper inputs, that would apply. The world market for finished copper-based products is more stable than that for copper.

A resource-based industrialisation strategy would therefore entail firstly the production of metal based products for the local market, secondly to supply the metal inputs to the regional industries, thirdly to export metal based products onto the world market and finally to export the remaining production onto the world markets still in the form of metal. For copper, the local market could absorb about 2% of production, the regional market about 10% and if a further 40% of production could be transformed before export, it would leave only half of production to be exported as metal with declining terms of trade. For lead and zinc, a regional resource based industrialization programme would enable the absorption of the bulk of production, especially after the planned production cut backs.

In fact the story of Zambian lead is an excellent example of the dangers of a mineral-export-based industrialisation strategy: From 1915 to 1988 eight hundred thousand tonnes of high grade lead was exported to the developed countries in exchange for their manufactured goods, some of which contained lead. At the same time the lead consumption by Zambian industry slowly increased to about 2,000 t/ann, only to be confronted with the end of lead supplies as the Kabwe mine was exhausted. Hence by the time that Zambian industry was developed enough to consume some of the country's lead, all that was left was a hole in the ground.

Over the last decade there has been an alarming stagnation of the Zambian agricultural sector and the resultant drift to the urban areas of peasant farmers. In 1974 cereal imports amounted to 93 kt, but by 1983 this had risen to 247 kt and then fell to 150 kt in 1987⁴¹. Maize was exported until 1976 (61 kt), but since then imports have generally had to be made to make up the shortfall. At independence in 1964 Zambia exported 12 kt of tobacco, but exports steadily fell to a low of 0.7 kt in 1986 before recovering somewhat to 2.5 kt in 1988 (0.2% of exports)⁴², an example of the small success of the export diversification programme.

Average food production per capita decreased by 26% from 1974-76 to 1981-83, though admittedly the country was in the throes of a drought in the latter period⁴³. The decline in agriculture has resulted in a movement of the rural population to the urban areas. By 1987 the urban population was estimated at almost 50% of the total, while at the same time earnings and employment in the urban areas has been declined.

The deterioration of the agricultural sector has been in part due to the fall in export earnings provoking a shortage of agricultural inputs, but it is also the result of low producer prices for agricultural commodities. Over the last three years producer prices have increased substantially in an effort to encourage production and at the same time real earnings of urban workers have been falling. Hopefully the combination of these two factors will halt and eventually reverse the drift to the urban areas.

Due to the extremely high dependence of the Zambian economy on metals mining, the restructuring of its economy must not only attempt to restructure the mining sector itself in terms of downstream processing, but must develop the country's other major resource, agriculture, to balance what is presently a lopsided copper economy. Doing this within the present situation of chronic foreign exchange shortages and a massive foreign debt burden is going to be extremely difficult.

A regionally integrated approach to the problem could well have a higher chance of success. The countries of the SADCC as a group do not have the same dependence on mining for export earnings (about 50% excluding oil). In addition many of the products presently imported by Zambia are produced elsewhere in the region (particularly Zimbabwe), while Zambia has both surplus power (HEP) and land.

Limited regional cooperation in metal refining has already taken place in the case of copper-nickel matte from Botswana being refined in Zimbabwe. Possibilities also exist for the refining in Zambia of the precious metal slimes from copper refining in Zimbabwe and the refining in Zimbabwe of any future nickel concentrate production from Munali in Zambia and cassiterite/tantalite/microlite/columbite concentrates from the Choma Tin belt. The SADCC Mining Coordinating Unit has an expatriate mining engineer to facilitate the regional sharing of processing facilities, but thus far all initiatives have been completely independent of the Unit, directly between the producer and refiner.

At present both Zambia and Zimbabwe are attempting to penetrate the same, fairly limited, regional market for copper and copper alloy semis and finished goods. In addition Zambia is planning an integrated iron and steel market that would compete with the already existing plant in Zimbabwe. Regional integration of the transformation of metals would necessitate the planning of the location of manufacturing plants to achieve an equitable distribution of the benefits and to avoid costly duplication. A possible partial solution to an efficient and equitable division, in the case of Zambia and Zimbabwe, would be for Zimbabwe to concentrate on ferrous products and Zambia to concentrate on non-ferrous products, instead of the current duplication and low capacity utilisation.

Such a division would also be based on each country's resources and experience in that the Zimbabwean copper mines are nearing the end of their life, it has no zinc production and almost no lead production, while Zambia has substantial copper reserves and limited reserves of lead and zinc. Neither country has significant aluminium occurrences. On the ferrous side, Zimbabwe has a well-established iron and steel plant and is a producer of ferrochrome, ferrosilicon chrome, ferrosilicon, ferromanganese, nickel and several other steel alloy metals.

The main obstacle to a rationalisation along these lines would be that it would require the transfer of recently installed non-ferrous plant from Zimbabwe to Zambia, which the Zimbabweans would not be

keen to do as they would not trust the Zambians to be capable of producing a product of sufficient quality and to be able to effect prompt delivery. It would also be extremely difficult to get the Reserve Bank of Zimbabwe to agree to the transfer.

On the Zambian side, however, it is quite likely that they would agree to shelve their iron and steel plant if they were sure that they could pay for all the ferrous products they need from Zimbabwe with their exports of non-ferrous products and semis to Zimbabwe.

In conclusion, the Zambian economy is highly dependent on copper mining and displays all the typical ailments of a mineral-based peripheral economy with a huge, unpayable, debt burden, in part contracted because the lenders relied on future mineral earnings for repayment. The main other resource, agriculture, received almost none of the mineral surpluses in the fifties and sixties and contracted until the improvement in prices for agricultural produce in the eighties. However, Zambia still has significant mineral resources, particularly of industrial, fertiliser and construction minerals for local development, and is thus likely to remain a mineral economy for some time, albeit at a lower level. The enormous investment in human resources for the mining industry over the last two decades will be wasted if alternative minerals are not developed.

With regard to regional integration in mining, Zambia, with the largest mining industry, could be a major beneficiary as it already produces many of the mining inputs imported by other countries in the region and it imports many items already produced in the region. It also imports several mineral and mineral-based items from the region, particularly iron and steel. However, the level of its copper and cobalt output is such that the region will not constitute a significant market in the short to medium term. The apparent low priority given by the Zambian government to its SADCC sectoral coordination responsibility is surprising given the advantages that could be gained by Zambia through regional integration in mining.

Footnotes

- 1 Freeman 1983.
 - 2 RCM 1978
 - 3 Freeman 1983.
 - 4 Alabert 1985
 - 5 AAC 1990, page 67.
 - 6 Hanlon 1986 p243.
 - 7 Significant indirect destabilisation was effected through the sabotage by RSA/UNITA of the Benguela line in Angola.
 - 8 Hanlon 1986 p252
 - 9 Hanlon 1986 p254.
 - 10 This section draws substantially on GSD 1986.
 - 11 Mezger 1980, 159.
 - 12 In 1988 the developed countries produced about 38% of non-socialist copper (BGS 1990, page 70)
 - 13 Mezger 1980, page 119.
 - 14 ZCCM 1989.
 - 15 Ohadike 1969 and Burawoy 1972
 - 16 Ohadike 1969.
 - 17 ZCCM 1989
 - 18 See table "ZCCM: Financial Profile"
 - 19 Radetzki 1985.
 - 20 Deloitte 1983.
 - 21 ZCCM 1989.
 - 22 Conversation with ZCCM Director, Len Mabson, 1986.
 - 23 Metal Bulletin No.7469, 26 March 1990, p10.
 - 24 Alabert 1985
 - 25 Note that in 1975 the NCCM definition of reserves was different to that used today by ZCCM, making an absolute comparison difficult.
 - 26 Metal Bulletin, No.7469, 26 March 1990, p10.
 - 27 British Mining Consultants Limited.
 - 28 Mining Journal, No.8053, 1990.
 - 29 Mining Journal, No.8057, p105, 1990.
 - 30 Mining Journal, No.8007, 17/02/89, p122.
 - 31 UNIDO 1986
 - 32 Metal Bulletin, No.7469, 26/03/90, p10.
 - 33 UNRFRNRE 1988.
 - 34 Vingerhoets 1985.
 - 35 Jourdan 1985.
 - 36 Vingerhoets 1987.
 - 37 Memaco 1985 p6.
 - 38 World Bank, 1985
 - 39 CSO 1974 and Vingerhoets 1985
 - 40 World Bank 1985 and 1989.
 - 41 World Bank 1985 & 1989.
 - 42 CSO 1974 & 1989.
 - 43 World Bank 1985.
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 - 38 World Bank, 1985
 - 39 CSO 1974 and Vingerhoets 1985
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 - 41 World Bank 1985 & 1989.
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 - 43 World Bank 1985.
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